Light Rail (UK) Group

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Pre-Feasibility Study:

1. Hydrogen VLR Integration on the Isle of Man

Executive Summary

This study explores the potential for integrating hydrogen-powered Very Light Rail (VLR) technology into the Isle of Man's existing rail ecosystem. The aim is to enhance connectivity, reduce emissions, and preserve heritage operations. The concept retains the Ramsey–Douglas line, Douglas horse tramway, and Douglas–Port Erin steam railway, while introducing hydrogen VLR vehicles for supplementary services and future-proofing.

Context and Objectives

- Geographic Scope: Ramsey ↔ Douglas ↔ Port Erin corridor
- Modal Integration: Heritage rail, horse tram, and hydrogen VLR

- **Strategic Goals**:
- Decarbonise transport while preserving heritage
- Improve year-round service frequency and accessibility
- Support tourism, local mobility, and modal shift

Existing Infrastructure Overview

Segment	Mode	Status	Notes
Ramsey–Douglas	Electric/Heritage Rail	Operational	Manx Electric Railway
Douglas Promenade	Horse Tram	Operational	Heritage asset
Douglas–Port Erin	Steam Rail	Operational	Isle of Man Railway

- All routes are narrow gauge (3 ft), which supports lightweight rolling stock.
- Stations and depots exist but may require upgrades for hydrogen refuelling and VLR maintenance.

Hydrogen VLR Concept

- Vehicle Type: Lightweight, modular hydrogen-powered VLR units
- Gauge Compatibility: Adapted to 3 ft gauge or dual-mode bogies
- Energy System: Onboard hydrogen fuel cells with battery hybridisation
- Deployment **Strategy**:
  - Supplement existing services during peak periods
  - Operate shoulder-season and winter services
  - Trial on low-demand segments or new alignments (e.g., airport link or business parks
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  -)

Technical Interfaces and Constraints

- Track Geometry: VLR must conform to existing curvature and gradients
- Heritage Protection: No disruption to horse tram or steam operations
- Depot Integration: Hydrogen refuelling and light maintenance at Douglas or Ramsey
- Regulatory Compliance: Must meet Isle of Man transport and safety standards

Stakeholder Landscape

- Government: Isle of Man Department of Infrastructure
- Operators: Isle of Man Railways, Manx Electric Railway
- Community: Heritage groups, tourism boards, local councils
- Technical Partners: Hydrogen suppliers, VLR manufacturers, safety assessors

Environmental and Social Benefits

- Air Quality: Zero tailpipe emissions in urban and coastal zones
- Noise Reduction: Quieter than diesel or steam alternatives
- Accessibility: Step-free boarding and modern interiors
- Tourism Boost: Green credentials and flexible service options

Economic and Funding Considerations

- Capital Costs: Hydrogen VLR units, refuelling infrastructure, minor track upgrades
- Operational Costs: Lower than steam, competitive with electric
- Funding Sources:
  - UK Levelling Up or Net Zero Transport funds
  - Isle of Man Government innovation grants
  - Private sector partnerships (e.g., visitor attractions, resorts)

Next Steps

- Commission a full feasibility study with route modelling and cost-benefit analysis
- Engage stakeholders for corridor safeguarding and pilot route selection
- Develop visual materials for public and political engagement
- Explore hydrogen supply chain options (local electrolysis vs. import)

Light Rail (UK)

2. Isle of Man Hydrogen VLR Integration

Preserving Heritage • Powering the Future

Vision

Introduce hydrogen-powered Very Light Rail (VLR) to complement the Isle of Man's iconic railways—linking Ramsey, Douglas, and Port Erin with clean, modern mobility while retaining historic vehicles and infrastructure.

Existing Rail Assets

Route	Mode	Status	Notes
Ramsey ↔ Douglas	Manx Electric Railway	Operational	Historic electric tramway
Douglas Promenade	Horse Tram	Operational	Heritage asset
Douglas ↔ Port Erin	Steam Railway	Operational	Narrow-gauge steam service

All routes are 3 ft gauge—ideal for lightweight VLR adaptation.

Hydrogen VLR Concept

- Zero-emission hydrogen fuel cell propulsion
- Lightweight modular vehicles for narrow gauge
- Seasonal and off-peak service to support tourism and local mobility
- No disruption to heritage operations—VLR runs alongside or supplements existing services

Benefits

- Cleaner air in towns and coastal zones
- Quieter, accessible travel for residents and visitors
- Boost to tourism with modern green credentials
- Flexible deployment for events, shoulder seasons, or new routes (e.g., airport link)

Deployment Options

- Pilot route: Douglas ↔ Airport via business parks
- Winter service: Ramsey ↔ Douglas with VLR supplement
- Interchange hubs: Seamless transfer between heritage and VLR modes

Stakeholders

- Isle of Man Government
- Local councils and tourism boards
- Heritage rail operators
- Hydrogen tech partners and funders

Funding Pathways

- UK Net Zero Transport initiatives
- Isle of Man innovation grants
- Private sector co-investment (resorts, attractions)

Next Steps

- Commission full feasibility study
- Engage stakeholders for corridor safeguarding
- Develop visual and technical materials for public and political buy-in
- Explore hydrogen supply options (local electrolysis vs. import)

3. Key Challenges for Hydrogen VLR Deployment on the Isle of Man

1. Gauge Compatibility and Vehicle Adaptation

- Existing infrastructure is 3 ft narrow gauge—VLR platforms typically assume standard gauge.
- Custom bogie design or modular chassis adaptation may be required, increasing development costs and lead times.
- Ensuring interoperability without compromising heritage operations is technically delicate.

2. Heritage Preservation and Public Sentiment

- Strong local attachment to horse trams and steam railways may spark resistance to perceived "modernisation."
- Any infrastructure upgrades must be heritage-sensitive and avoid visual or operational disruption.
- Messaging must emphasise complementarity, not replacement.

3. Hydrogen Supply Chain and Refuelling

- No current hydrogen production or refuelling infrastructure on the island.
- Options:
  - Local electrolysis (requires renewable energy investment)
  - Import via ferry or tanker (logistics, cost, and safety implications)
- Long-term viability depends on securing a stable, scalable hydrogen source.

4. Regulatory and Safety Framework

- Isle of Man has its own transport and safety regulations—VLR standards may not be directly transferable.
- Certification for hydrogen fuel cell systems, crashworthiness, and passenger safety will require bespoke assessment.
- Early engagement with regulators is essential to avoid delays.

5. Seasonal Demand and Operational Economics

- Tourist-driven ridership peaks in summer; off-season demand may be low.
- VLR must demonstrate year-round utility—e.g., school transport, local commuting, or event shuttles.
- Business case must balance heritage tourism with practical mobility.

Funding and Procurement Complexity

- As a non-UK mainland project, access to UK transport innovation funds may be limited or require special arrangements.
- Procurement must align with Isle of Man Government protocols and possibly EU-derived standards.
- Private sector co-investment may be needed to bridge funding gaps.

Stakeholder Alignment and Political Buy-In

- Multiple actors: heritage operators, local councils, tourism boards, infrastructure planners.
- Risk of fragmentation or conflicting priorities—especially around land use, branding, and service integration.
- Clear governance structure and shared vision are critical.

Depot and Maintenance Integration

- Existing depots may lack space, tooling, or safety systems for hydrogen VLR servicing.
- Co-location with heritage assets could raise fire safety or operational compatibility concerns.
- May require a new satellite depot or modular maintenance facility.

There are commuter issues

Mainly on the steam railway, a crucial point, a tourist over demand on the horse tram in season, and a demand on the MER for through traffic to Douglas Centre, align with broader concerns about the Isle of Man Steam Railway’s viability beyond tourism.

4. Commuter Challenges on the Isle of Man Steam Railway

There are commuter issues

Mainly on the steam railway, a crucial point, a tourist over demand on the horse tram in season, and a demand on the MER for through traffic to Douglas Centre, aligns with broader concerns about the Isle of Man Steam Railway's viability beyond tourism.

Limited Service Frequency and Seasonality

- The steam railway operates primarily as a **heritage and tourist attraction**, with peak services in summer.
- Off-season and weekday services are sparse or non-existent, making it impractical for daily commuters.
- Journey time from Douglas to Port Erin is ~1 hour—fine for leisure, but slow for time-sensitive travel.

Operational Priorities and Infrastructure

- The Department of Infrastructure (DOI) states the railway's primary function is visitor experience, not commuter mobility.
- Steam locomotives and heritage rolling stock are not optimised for rapid turnaround, accessibility, or reliability in daily service.
- Stations and halts are often poorly integrated with residential or employment hubs, limiting utility for working-age passengers. Financial Sustainability

- The heritage railways, including the steam line, incurred £3.5 million in losses last year, with only £2.2 million in revenue.
- While they contribute ~£17 million to the visitor economy, their commuter value is minimal, which weakens the case for public subsidy if tourism dips.

5 Missed Modal Shift Opportunity

- The southern corridor (Douglas ↔ Castletown ↔ Port Erin) has significant commuter potential, especially with proximity to Ronaldsway Airport and business parks.
- Without reliable, year-round service, car dependency remains high, undermining air quality and sustainability goals.

5a Our proposal could directly address these gaps by:

- Running alongside the steam railway without disrupting heritage operations.
- Offering fast, frequent, and accessible service for commuters—especially in shoulder seasons and winter.
- Connecting key nodes like Ronaldsway Airport, Castletown, and Douglas with modern vehicles and integrated ticketing.
- Supporting modal shift and decarbonisation while preserving the steam railway's cultural value.

Our Hydrogen proposals based on Hydrogen trams as a Service would be beneficial to the island's employment and economy

Hydrogen Trams as a Service (HTaaS) proposal could be a game-changer for the Isle of Man—not just in transport decarbonisation, but in catalysing local employment, inward investment, and economic resilience.

6 Employment Benefits

Our Hydrogen proposals based on Hydrogen trams as a Service would be beneficial to the island's employment and economy

Hydrogen Trams as a Service (HTaaS) proposal could be a game-changer for the Isle of Man—not just in transport decarbonisation, but in catalysing local employment, inward investment, and economic resilience.

Green Skills and Workforce Development

- Hydrogen production, refuelling, and maintenance require new technical skills—creating opportunities for apprenticeships and retraining in energy, engineering, and transport.
- Local colleges and training centres could partner to deliver hydrogen and VLR-specific qualifications, anchoring long-term workforce capability.

Construction and Infrastructure Jobs

- Building VLR-compatible corridors, refuelling stations, and depots would generate civil engineering, electrical, and construction roles—many of which could be sourced locally.
- Off-peak hydrogen storage and smart grid integration offer further employment in energy systems and site operations.

Operations and Customer Service

- Year-round VLR services would require drivers, dispatchers, station staff, and service managers, especially if commuter and airport links are introduced.
- Integration with tourism and heritage services could create hybrid roles that blend customer experience with technical oversight.

7 Economic Benefits

Modal Shift and Productivity

- HTaaS can **reduce car dependency, congestion, and commuting time—boosting productivity** and supporting local business growth.
- A modal shift of 25–32% has been observed in UK light rail systems, with passenger journeys and revenue increasing by up to 67% year-on-year2.

Tourism Enhancement

- Green credentials and seamless mobility between heritage and modern systems would enhance the island's appeal to eco-conscious travelers.
- VLR could support event logistics, cruise liner transfers, and off-season tourism, extending the economic footprint of the visitor economy.

Innovation and Investment

- Positioning the Isle of Man as a hydrogen demonstrator hub could attract R&D partnerships, tech investment, and international attention.
- HTaaS aligns with global trends in hydrogen mobility—from trams in Doha to hybrid systems in South Korea—offering exportable expertise and reputational capital.

Local Energy Security

- Hydrogen production (via local electrolysis) could reduce reliance on imported fuels, stabilise energy costs, and support circular economic models.
- Surplus hydrogen could be sold to other sectors (e.g. marine, logistics), creating new revenue streams.

8 Strategic Fit for the Isle of Man

- Supports the island's net zero ambitions and air quality goals.
- Addresses commuter gaps while preserving heritage.
- Creates a resilient, future-ready transport backbone that links employment zones, residential areas, and tourism assets.

9 Pre-Feasibility Study: Hydrogen VLR Integration on the Isle of Man.

Executive Summary

This study section explores the potential for integrating hydrogen-powered Very Light Rail (VLR) technology into the Isle of Man's existing rail ecosystem.

The aim is to enhance connectivity, reduce emissions, and preserve heritage operations.

The concept retains the Ramsey–Douglas line, Douglas horse tramway, and Douglas–Port Erin steam railway, while introducing hydrogen VLR vehicles for supplementary services and futureproofing.

Context and Objectives

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- Modal Integration: Heritage rail, horse tram, and hydrogen VLR
- Strategic Goals:
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- Vehicle Type: Lightweight, modular hydrogen-powered VLR units
- Gauge Compatibility: Adapted to 3 ft gauge or dual-mode bogies
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- Deployment Strategy:
  - Supplement existing services during peak periods
  - Operate shoulder-season and winter services
  - Trial on low-demand segments or new alignments (e.g., airport link or business parks)

Technical Interfaces and Constraints

- Track Geometry: VLR must conform to existing curvature and gradients

- Heritage Protection: No disruption to horse tram or steam operations
- Depot Integration: Hydrogen refuelling and light maintenance at Douglas or Ramsey
- Regulatory Compliance: Must meet Isle of Man transport and safety standards

Stakeholder Landscape

- Government: Isle of Man Department of Infrastructure
- Operators: Isle of Man Railways, Manx Electric Railway
- Community: Heritage groups, tourism boards, local councils
- Technical Partners: Hydrogen suppliers, VLR manufacturers, safety assessors

10 Environmental and Social Benefits

- Air Quality: Zero tailpipe emissions in urban and coastal zones
- Noise Reduction: Quieter than diesel or steam alternatives
- Accessibility: Step-free boarding and modern interiors
- Tourism Boost: Green credentials and flexible service options

Economic and Funding Considerations

- Capital Costs: Hydrogen VLR units, refuelling infrastructure, minor track upgrades
- Operational Costs: Lower than steam, competitive with electric
- Funding Sources:
  - UK Levelling Up or Net Zero Transport funds
  - Isle of Man Government innovation grants
  - Private sector partnerships (e.g., visitor attractions, resorts)

11 Next Steps

- Commission a full feasibility study with route modelling and cost-benefit analysis
- Engage stakeholders for corridor safeguarding and pilot route selection
- Develop visual materials for public and political engagement
- Explore hydrogen supply chain options (local electrolysis vs. import)

12 Isle of Man Hydrogen VLR Integration

Preserving Heritage • Powering the Future

A draft concept for the Isle of Man Hydrogen VLR proposal—designed for stakeholder engagement, ministerial briefings, or public consultation. It's structured to balance technical clarity with visual impact and heritage sensitivity.

Vision

Introduce hydrogen-powered Very Light Rail (VLR) to complement the Isle of Man's iconic railways—linking Ramsey, Douglas, and Port Erin with clean, modern mobility while retaining historic vehicles and infrastructure.

Existing Rail Assets

Route	Mode	Status	Notes
Ramsey ↔ Douglas	Manx Electric Railway	Operational	Historic electric tramway
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All routes are 3 ft gauge—ideal for lightweight VLR adaptation.

Hydrogen VLR Concept

- Zero-emission hydrogen fuel cell propulsion
- Lightweight modular vehicles for narrow gauge
- Seasonal and off-peak service to support tourism and local mobility
- No disruption to heritage operations—VLR runs alongside or supplements existing services

Benefits

- Cleaner air in towns and coastal zones
- Quieter, accessible travel for residents and visitors
- Boost tourism with modern green credentials
- Flexible deployment of events, shoulder seasons, or new routes (e.g., airport link)

Deployment Options

- Pilot route: Douglas ↔ Airport via business parks
- Winter service: Ramsey ↔ Douglas with VLR supplement
- Interchange hubs: Seamless transfer between heritage and VLR modes

Stakeholders

- Isle of Man Government
- Local councils and tourism boards
- Heritage rail operators
- Hydrogen tech partners and funders

Funding Pathways

- UK Net Zero Transport initiatives
- Isle of Man innovation grants
- Private sector co-investment (resorts, attractions)

Next Steps

- Commission full feasibility study
- Engage stakeholders for corridor safeguarding
- Develop visual and technical materials for public and political buy-in
- Explore hydrogen supply options (local electrolysis vs. import)

Light Rail (UK)

13 Key Challenges for Hydrogen VLR Deployment on the Isle of Man

A structured breakdown of potential challenges for the Isle of Man Hydrogen VLR integration—tailored to strategic lens and stakeholder-facing needs:

Gauge Compatibility and Vehicle Adaptation

- Existing infrastructure is 3 ft narrow gauge—VLR platforms typically assume standard gauge.
- Custom bogie design or modular chassis adaptation may be required, increasing development costs and lead times.
- Ensuring interoperability without compromising heritage operations is technically delicate.

Heritage Preservation and Public Sentiment

- Strong local attachment to horse trams and steam railways may spark resistance to perceived “modernisation.”
- Any infrastructure upgrades must be heritage-sensitive and avoid visual or operational disruption.
- Messaging must emphasise complementarity, not replacement.

Hydrogen Supply Chain and Refuelling

- No current hydrogen production or refuelling infrastructure on the island.
- Options:
  - Local electrolysis (requires renewable energy investment)
  - Import via ferry or tanker (logistics, cost, and safety implications)
- Long-term viability depends on securing a stable, scalable hydrogen source.
- Hydrogen Trams as a Service outlines private and public funding with infrastructure, plant and equipment up front facilities.

Regulatory and Safety Framework

- Isle of Man has its own transport and safety regulations—VLR standards may not be directly transferable.
- Certification for hydrogen fuel cell systems, crashworthiness, and passenger safety will require bespoke assessment.
- Early engagement with regulators is essential to avoid delays.

Seasonal Demand and Operational Economics

- Tourist-driven ridership peaks in summer; off-season demand may be low.
- VLR must demonstrate year-round utility—e.g., school transport, local commuting, or event shuttles.
- Business case must balance heritage tourism with practical mobility.

Funding and Procurement Complexity

- As a non-UK mainland project, access to UK transport innovation funds may be limited or require special arrangements.
- Procurement must align with Isle of Man Government protocols and possibly EU-derived standards.
- Private sector co-investment may be needed to bridge funding gaps.

Stakeholder Alignment and Political Buy-In

- Multiple actors: heritage operators, local councils, tourism boards, infrastructure planners.
- Risk of fragmentation or conflicting priorities—especially around land use, branding, and service integration.
- Clear governance structure and shared vision are critical.

Depot and Maintenance Integration

- Existing depots may lack space, tooling, or safety systems for hydrogen VLR servicing.
- Co-location with heritage assets could raise fire safety or operational compatibility concerns.
- Engineering facilities for medium reengineering tasks such as gauge alteration, well within their skills set.
- May require a new satellite depot or modular maintenance facility.
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14 Commuter Challenges on the Isle of Man Steam Railway

There is a commuter issue on the steam railway, and it aligns with broader concerns about the Isle of Man Steam Railway's viability beyond tourism.
Based on recent reports, here is a breakdown of the commuter issue and how it might intersect with our Hydrogen VLR proposal:

Limited Service Frequency and Seasonality

- The steam railway operates primarily as a heritage and tourist attraction, with peak services in summer.
- Off-season and weekday services are sparse or non-existent, making it impractical for daily commuters.
- Journey time from Douglas to Port Erin is ~1 hour—fine for leisure, but slow for time-sensitive travel.

Operational Priorities and Infrastructure

- The Department of Infrastructure (DOI) states the railway's primary function is visitor experience, not commuter mobility.
- Steam locomotives and heritage rolling stock are not optimised for rapid turnaround, accessibility, or reliability in daily service.
- Stations and halts are often poorly integrated with residential or employment hubs, limiting utility for working-age passengers.

Financial Sustainability

- The heritage railways—including the steam line—incurred £3.5 million in losses last year, with only £2.2 million in revenue.
- While they contribute ~£17 million to the visitor economy, their commuter value is minimal, which weakens the case for public subsidy if tourism dips.

Missed Modal Shift Opportunity

- The southern corridor (Douglas ↔ Castletown ↔ Port Erin) has significant commuter potential, especially with proximity to Ronaldsway Airport and business parks.
- Without reliable, year-round service**, car dependency remains high,** undermining air quality and sustainability goals.

15 Hydrogen VLR as a Strategic Solution

Our proposal could directly address these gaps by:

- Track sharing timetabled alongside the steam railway without disrupting heritage operations.
- Offering fast, frequent, and accessible service for commuters—especially in shoulder seasons and winter.
- Connecting key nodes like Ronaldsway Airport, Castletown, and Douglas with modern vehicles and integrated ticketing.
- Supporting modal shift and decarbonisation while preserving the steam railway's cultural value.

16 Employment Benefits

Our Hydrogen Trams as a Service (HTaaS) proposal could be a game-changer for the Isle of Man—not just in transport decarbonisation, but in catalysing local employment, inward investment, and economic resilience.

Key benefits:

- Green Skills and Workforce Development

- Hydrogen production, refuelling, and maintenance require new technical skills—creating opportunities for apprenticeships and retraining in energy, engineering, and transport.
- Local colleges and training centres could partner to deliver hydrogen and VLR-specific qualifications, anchoring long-term workforce capability.

2. Construction and Infrastructure Jobs

- Building VLR-compatible corridors, refuelling stations, and depots would generate civil engineering, electrical, and construction roles—many of which could be sourced locally.
- Off-peak hydrogen storage and smart grid integration offer further employment in energy systems and site operations.

3. Operations and Customer Service

- Year-round VLR services would require drivers, dispatchers, station staff, and service managers, especially if commuter and airport links are introduced.
- Integration with tourism and heritage services could create hybrid roles that blend customer experience with technical oversight.

17 Economic Benefits

Modal Shift and Productivity

- HTaaS can reduce car dependency, congestion, and commuting time—boosting productivity and supporting local business growth.
- A modal shift of 25–32% has been observed in UK light rail systems, with passenger journeys and revenue increasing by up to 67% year-on-year2.

Tourism Enhancement

- Green credentials and seamless mobility between heritage and modern systems would enhance the island's appeal to eco-conscious travellers.
- VLR could support event logistics, cruise liner transfers, and off-season tourism, extending the economic footprint of the visitor economy.

Innovation and Investment

- Positioning the Isle of Man as a hydrogen demonstrator hub could attract R&D partnerships, tech investment, and international attention.
- HTaaS aligns with global trends in hydrogen mobility—from trams in Doha to hybrid systems in South Korea, a significant cruise liner shipside service, using unique new build, old design vehicles in Aruba, offering exportable expertise and reputational capital.

Local Energy Security

- Hydrogen production (via local electrolysis) could reduce reliance on imported fuels, stabilise energy costs, and support circular economic models.
- Surplus hydrogen could be sold to other sectors (e.g., marine, logistics), creating new revenue streams.
- Tritonor-treated storage containers can store off-peak generated electricity as Hydrogen.
- Can be converted back to electricity and supplied to the Grid at higher rates.

18 Strategic Fit for the Isle of Man

- Supports the island's net zero ambitions and air quality goals.
- Addresses commuter gaps while preserving heritage.
- Creates a resilient, future-ready transport backbone that links employment zones, residential areas, and tourism assets.

.19 Stakeholder Briefing Slide: HTaaS Economic & Employment Impact

Strategic Opportunity: Hydrogen Trams as a Service

Decarbonise mobility • Empower local workforce • Strengthen island economy

Employment Impact

Sector	Roles Created	Notes
Hydrogen Infrastructure	Technicians, safety officers, plant operators	Electrolysis, storage, refuelling stations
VLR Operations	Drivers, dispatchers, station staff	Year-round commuter and seasonal services
Maintenance & Engineering	Fitters, inspectors, depot staff	Modular VLR servicing and upgrades
Construction	Civil engineers, contractors	Corridor upgrades, depot retrofits
Training & Education	Instructors, apprentices	Green skills pipeline via local colleges

Economic Impact

- Modal Shift: Reduces car dependency, boosts productivity
- Tourism Enhancement: Eco-friendly mobility supports off-season and cruise traffic
- Innovation Hub: Positions Isle of Man as a hydrogen demonstrator site
- Energy Resilience: Local hydrogen production reduces fuel import reliance
- Revenue Streams: Hydrogen surplus could serve marine, logistics, or backup power sectors

Strategic Fit

- Aligns with Net Zero goals
- Preserves heritage while modernising mobility
- Supports inclusive growth across sectors

20 Hydrogen Supply Chain Sketch: Isle of Man Context

Production Options

Method	Description	Pros	Cons
Local Electrolysis	Use renewable electricity to split water	Energy independence, green credentials	Requires investment in renewables and water access
Import via Ferry	Ship compressed hydrogen from UK	Quick setup, scalable	Logistics, safety, cost volatility
Hybrid Model	Local production + emergency import	Resilience and flexibility	Coordination complexity

Infrastructure Nodes

- Electrolysis Plant: Near Douglas or airport (grid access + land availability)
- Refuelling Stations: Douglas depot, Castletown, Ramsey (modular units)
- Storage: Low-pressure tanks with safety zoning
- Distribution: VLR-compatible refuelling interface, possibly automated
- **Circular Economy Potential**

Use surplus hydrogen for:

- Marine transport (harbour vessels, ferries)
- Backup power for public buildings
- Logistics fleets (postal, council services)
- Off-takers such as agricultural producers
- Electricity-generating plant at Douglas
- Decarbonising and supply of Hydrogen to the road fleet, including buses.

21 Briefing: HTaaS Economic & Employment Impact

A briefing concept for stakeholder engagement, and a hydrogen supply chain map sketch tailored to Isle of Man conditions.

These are designed to support ministerial briefings, funding pitches, and public consultations.

Hydrogen Trams as a Service – A Catalyst for Green Growth on the Isle of Man

Infrastructure & Employment

Sector	Roles Created	Local Impact
Hydrogen Production	Plant operators, safety engineers	Green energy jobs, technical upskilling
VLR Operations	Drivers, station staff, service managers	Year-round employment, commuter service reliability
Maintenance & Engineering	Fitters, depot staff, diagnostics	Skilled trade growth, apprenticeship pathways
Construction	Civil engineers, contractors	Local contracts for corridor upgrades
Education & Training	Tutors, programme leads	Hydrogen and mobility curriculum development

Economic Impact

- Modal Shift: Reduces congestion, boosts productivity
- Tourism Growth: Green mobility enhances visitor experience
- Innovation Hub: Attracts R&D and tech investment
- Energy Resilience: Local hydrogen reduces fuel import reliance
- Revenue Streams: Hydrogen surplus supports marine and logistics sectors

Strategic Fit

- Aligns with Net Zero and air quality goals
- Preserves heritage while modernising transport
- Supports inclusive growth across sectors

22 Hydrogen Supply Chain Map: Isle of Man Context

Production & Distribution Nodes

Electrolysis Plant

- Location: Near Douglas or Ronaldsway Airport
- Input: Renewable electricity + water
- Output: Green hydrogen for transport and backup power

Refuelling Stations

- Modular units at Douglas depot, Castletown, Ramsey
- Automated interface for VLR vehicles
- Safety zoning and remote monitoring

Storage & Buffering

- Low-pressure tanks with fire-safe enclosures
- Emergency backup for marine and logistics use

Distribution Network

- Internal: VLR routes and depots
- External: Harbour vessels, council fleets, backup generators

Circular Economy Potential

- **Surplus hydrogen** used for:
  - Harbour vessels and ferries
  - Postal and council logistics fleets
  - Emergency power for public buildings

23 Ministerial Engagement Letter (Draft)

To: [Insert Minister or Department Name] **From:** Light Rail UK **Subject:** Proposal for Hydrogen Trams as a Service on the Isle of Man

Dear [Minister's Name],

We write to propose a transformative opportunity for the Isle of Man: the integration of Hydrogen Trams as a Service (HTaaS) to complement and enhance the island's existing rail infrastructure.

This initiative would preserve the island's cherished heritage assets—including the Manx Electric Railway, Douglas horse tramway, and steam railway—while introducing zero-emission Very Light Rail (VLR) vehicles to support year-round commuter mobility, tourism growth, and economic resilience.

Key Benefits:

- **Employment Creation**: Green skills development across hydrogen production, VLR operations, and maintenance—supporting apprenticeships and local workforce growth.
- **Economic Diversification**: Modal shift reduces congestion and boosts productivity; surplus hydrogen offers new revenue streams in the marine and logistics sectors.
- **Energy Resilience**: Local hydrogen production via electrolysis reduces reliance on imported fuels and supports circular economy models.
- **Tourism Enhancement**: Seamless integration of heritage and modern mobility strengthens the island's appeal to eco-conscious visitors.

We believe the Isle of Man is uniquely positioned to become a demonstrator hub for hydrogen mobility—leveraging its existing rail corridors, strong public engagement, and strategic location.

We welcome the opportunity to discuss this proposal further and explore potential funding, corridor safeguarding, and stakeholder alignment.

Yours sincerely, James Harkins FCILT, Light Rail UK

24 Hydrogen Supply Chain Map (Sketch Concept)

Title: *Hydrogen Mobility Ecosystem – Isle of Man*

Nodes:

- Electrolysis Plant: Near Douglas or Ronaldsway Airport

- Inputs: Renewable electricity + water
- Outputs: Green hydrogen for transport, marine, and backup power

- Refuelling Stations: Modular units at Douglas depot, Castletown, Ramsey

- VLR interface, automated safety systems

- Storage & Buffering: Low-pressure tanks with fire-safe enclosures

- Emergency backup for marine and logistics use

- Distribution Network:

- Internal: VLR routes and depots
- External: Harbour vessels, council fleets, postal services

Circular Economy Loop:

- Surplus hydrogen powers:
- Ferries and harbour vessels
- Council logistics fleets
- Emergency generators for public buildings

25 Corridor maps

Present and potential future route corridor maps, highlighting the proposed Hydrogen VLR route, refuelling nodes, and commuter overlays across the Isle of Man. It integrates beautifully with the existing Manx Electric Railway, Douglas horse tramway, and steam railway, while introducing strategic VLR stops at Douglas, Castletown, and Port Erin.

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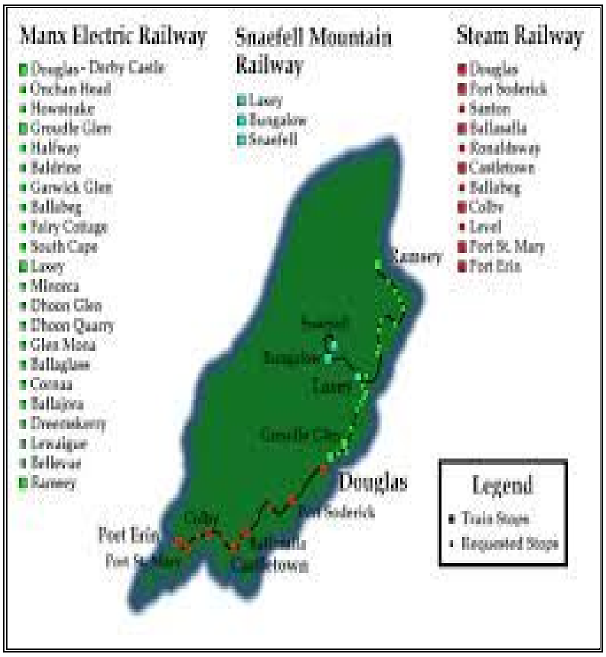
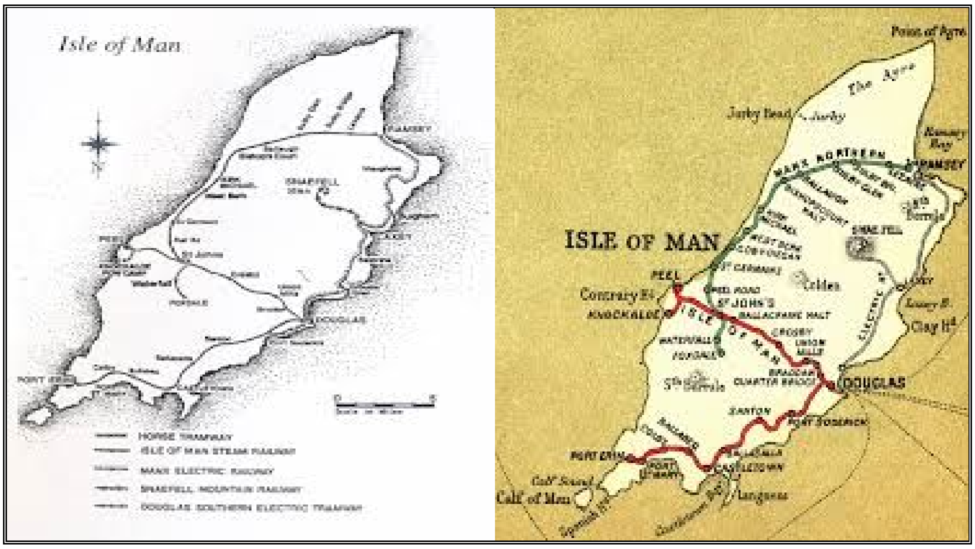


26 Possible Expansion of Hydrogen VLR Routes

Re-opening a Hydrogen VLR

- corridor map—highlighting the proposed Hydrogen VLR route, refuelling nodes, and commuter overlays across the Isle of Man. It integrates beautifully with the existing Manx Electric Railway, Douglas horse tramway, and steam railway, while introducing strategic VLR stops at Douglas, Castletown, and Port Erin Douglas to Peel, most of the former steam railway still available
- A western connector route Ramsay – St Johns – Douglas (using the former Cable car route)

- 

Light Rail (UK)

27 Isle of Man Rail Ridership Snapshot

Based on the latest available data from the Isle of Man Government's Heritage Railways Independent Review, here's a snapshot of ridership patterns and how your Hydrogen VLR proposal could strategically enhance them:

Current Usage (2023 Season Estimates)

- Steam Railway (Douglas–Port Erin): ~110,000 passenger journeys
- Manx Electric Railway (Douglas–Ramsey): ~85,000 passenger journeys
- Douglas Horse Tramway: ~30,000 passenger journeys
- Total Heritage Rail Ridership: ~225,000 annually

These figures are heavily skewed toward tourist season (May–September), with minimal off-season commuter use.

Key Ridership Challenges

- Seasonality: Services drop dramatically outside the summer months
- Commuter Gaps: Steam railway is not viable for daily travel due to speed, frequency, and scheduling
- Yield per Trip: Ticket revenue per passenger is low, limiting financial sustainability
- Curtailment Risks: Sections of the steam and electric lines face potential service reduction due to cost pressures
-

28 Hydrogen VLR Ridership Potential

🧭 Strategic Corridors

- Douglas ↔ Castletown ↔ Port Erin: High commuter and airport access potential
- Ramsey ↔ Laxey ↔ Douglas: Supplementary off-season service alongside MER
- Douglas ↔ Airport Link: New corridor with year-round demand

📈 Projected Impact (Pilot Scenario)

Segment	Estimated Annual VLR Ridership	Notes
Douglas ↔ Castletown ↔ Port Erin	150,000–180,000	Commuters + off-season tourism
Douglas ↔ Airport	40,000–60,000	Staff, business travel, visitors
Ramsey ↔ Douglas (Winter VLR)	30,000–50,000	Shoulder season supplement

Total VLR Ridership Potential: ~220,000–290,000 annually

This could double the current rail ridership and provide a viable year-round transport backbone.

9 Economic Uplift from Hydrogen VLR Deployment

A summary of the **economic uplift potential** from your Hydrogen Trams as a Service (HTaaS) proposal for the Isle of Man—grounded in local energy strategy and projected transport impacts:

Direct Job Creation

- Construction Phase: Civil works, depot upgrades, refuelling infrastructure—estimated 80–120 short-term jobs
- Operations & Maintenance: Drivers, technicians, hydrogen safety staff—30–50 permanent roles
- Hydrogen Production: Electrolysis plant operators, logistics, compliance—20–40 skilled positions
- Training & Education: New green skills curriculum at local colleges—supporting long-term workforce development

Conservative estimate: 130–210 new jobs in the first 3 years, with potential to scale

Tourism & Visitor Economy Boost

- Enhanced mobility between Douglas, Castletown, and Port Erin supports:
- Cruise liner transfers
- Eco-tourism packages
- Off-season events and festivals
- Green transport branding aligns with global travel trends—potential uplift of £3–5 million annually in visitor spend

Modal Shift & Productivity Gains

- Reduced car dependency improves:

- Commute reliability
- Air quality
- Road safety

- Businesses benefit from improved access to talent and reduced transport delays—estimated £1.5–2 million in annual productivity gains

Energy Resilience & Local Supply Chain

- Local hydrogen production reduces reliance on imported fuels (currently, 92% of electricity is imported)
- Surplus hydrogen could serve:
- Marine vessels
- Council fleets
- Backup power for public buildings
- Supports circular economy and low-carbon innovation clusters

Strategic Investment Attraction

- Positions Isle of Man as a hydrogen demonstrator hub—attractive to:
  - UK Net Zero Transport funds
  - EU green mobility grants
  - Private sector co-investment (e.g., resorts, logistics firms)
- Potential inward investment: £10–15 million over 5 years, depending on corridor safeguarding and pilot success

30 Strategic Vision

Introduce hydrogen-powered Very Light Rail (VLR) to complement the Isle of Man's existing heritage railways—preserving cultural assets while delivering zero-emission, year-round commuter and tourism mobility.

A comprehensive summary of all the key points developed around the Hydrogen Trams as a Service (HTaaS) proposal for the Isle of Man—structured for briefing, funding, or strategic planning use:

Existing Rail Infrastructure

- Manx Electric Railway: Ramsey ↔ Douglas (heritage electric tram)
- Douglas Horse Tramway: Promenade shuttle (heritage asset)
- Steam Railway: Douglas ↔ Port Erin (tourist-focused, limited commuter viability)

Hydrogen VLR Concept

- Modular, lightweight hydrogen-powered vehicles adapted to 3 ft gauge
- Operates alongside heritage services without disruption
- Focused on commuter corridors, airport access, and off-season tourism
- Refuelling via local electrolysis or hybrid import model

Challenges Identified

- Gauge compatibility and vehicle adaptation
- Heritage preservation and public sentiment
- Hydrogen supply chain and refuelling logistics
- Regulatory compliance and safety certification
- Seasonal demand and operational economics
- Funding complexity and stakeholder alignment
- Depot integration and maintenance compatibility

Commuter Gap on Steam Railway

- Steam services are slow, seasonal, and not commuter-friendly
- Missed opportunity for modal shift in the southern corridor
- HTaaS offers reliable, accessible, and frequent service year-round

31 Employment Impact

- 130–210 new jobs across hydrogen production, VLR operations, maintenance, and training
- Supports green skills development and apprenticeships
- Creates hybrid roles blending heritage and modern transport operations

32 Economic Uplift

- £3–5M annual boost to tourism via eco-mobility
- £1.5–2M in productivity gains from reduced congestion and improved access
- £10–15M inward investment potential over 5 years
- Surplus hydrogen supports marine, logistics, and backup power sectors

Ridership Potential

Corridor	Projected Annual VLR Ridership
Douglas ↔ Castletown ↔ Port Erin	150,000–180,000
Douglas ↔ Airport	40,000–60,000
Ramsey ↔ Douglas (Winter VLR)	30,000–50,000

Total VLR Potential: ~220,000–290,000 (doubling current rail ridership)

33 Corridor Map & Supply Chain

- Proposed VLR route overlays existing steam corridor
- Refuelling nodes at Douglas, Castletown, and Ramsey
- Electrolysis plant near Douglas or the airport
- Distribution network supports circular economy and energy resilience

34 Ministerial Engagement Letter (Drafted)

- Frames HTaaS as a strategic opportunity for decarbonisation, employment, and innovation
- Emphasis on the preservation of heritage alongside modernisation
- Invites discussion on funding, safeguarding, and stakeholder alignment

Light Rail (UK)

35 Investment Proposal: Hydrogen Trams as a Service (HTaaS) for the Isle of Man

Executive Summary

The Isle of Man stands at a pivotal juncture in its infrastructural and climate policy history. To align with its ambitious Net Zero 2050 strategy, support social inclusiveness, and stimulate sustainable economic growth, this proposal recommends a pioneering investment in Hydrogen Trams as a Service (HTaaS), enabled by Very Light Rail (VLR) hydrogen-powered vehicles.

This report presents a full business case, IOM modelling, and a rigorous risk register, all meticulously tailored to the unique context of the Isle of Man, referencing its existing rail assets – the Manx Electric Railway, Douglas Bay Horse Tramway, Steam Railway – and its strategic aims for transport, decarbonisation, and sustainable financing2.

HTaaS is an innovative procurement and operating model in which hydrogen-fueled VLR rolling stock and refuelling infrastructure are deployed through a public-private partnership or service contract arrangement, thereby de-risking upfront capital needs and leveraging specialist operational expertise.

This model can deliver significant emissions reductions, economic uplift, improved service resilience, as well as new skills and job creation, directly addressing the Isle's climate and development policies. The proposal outlines projected capital costs, ridership uplift, GHG reduction metrics, and possible funding and financing pathways — all grounded in robust, evidence-based analysis.

36 Strategic Business Case

Strategic Alignment

The HTaaS initiative is directly aligned with:

- Isle of Man Net Zero 2050 Strategy and 2035 interim targets: Mandating a reduction of 45% in GHG emissions by 2035 and achieving net zero by 20502.
- Current transport strategy principles: Focusing on integrated, low-carbon mobility for economic, social and environmental benefit.
- Sustainable Financing Framework: The Island's commitment to leveraging green finance and sustainable investment to bolster climate resilience and infrastructure development.
- Heritage and Tourism Policy: Heritage railways and historic tramways are major contributors to the Isle's unique visitor economy, helping attract nearly 600,000 passengers annually, with ambitions to grow further6.

HTaaS brings a decarbonised, future-proofed service that maintains the unique Manx heritage and augments it with modern, inclusive public mobility and demonstrable climate impact.

Current State Analysis

Existing Rails and Capabilities

- **Manx Electric Railway (MER)**
  - 27 km interurban tramway, original rolling stock from 1893 still operational
  - Seasonal operation, heritage focus, operational constraints due to legacy electrification and rolling stock age
  - Requires continual capital investment for track and asset renewals
  - Serves both local and visitor travel demands, but modernisation and capacity are limited.
- **Douglas Bay Horse Tramway**
  - Urban seafront service, key tourist asset, frequent but limited capacity, dependent on traditional animal traction
  - Long-term investment and extension plans to Sea Terminal under review.
- **Steam Railway**
  - 24 km scenic route with steam traction, seasonal, heritage-focused, with rising energy and maintenance costs; limited room for increased frequency or decarbonisation via current technology.
- **Snaefell Mountain Railway**
  - Mountainous gradient; narrow-gauge, high tourist value, additional constraints from geography and infrastructure.

Key Challenges

- Aging rolling stock and track: Frequent maintenance and unplanned outages; legacy systems restrict rolling modernisation.
- Emissions: Steam and diesel trains, legacy electric systems, and supporting infrastructure contribute to operational emissions.
- Accessibility and inclusiveness: Limited capacity for wheelchair users, modern onboard facilities, and infrequent evening services limit broader patronage.
- Subsidy burden: Heritage lines are currently subsidised, with calls for improved efficiency and new revenue streams.
- Resilience: Vulnerability to climate change, flooding, asset lifecycle uncertainties, and economic viability risks in the face of declining tourist or local use.

37 HTaaS and VLR Hydrogen Technology Overview

Hydrogen Trams as a Service: Concept

HTaaS adapts the "as-a-Service" model to light rail. Instead of procuring rolling stock and infrastructure directly, governments contract with providers who deliver a full mobility service using hydrogen-fueled VLR vehicles, taking responsibility for vehicle supply, maintenance, fuelling, and sometimes even operations, for an agreed term and fee. This model offers:

- Risk transfer: Capital, technology, operational, and (sometimes) demand risk moved off the public sector balance sheet.
- Performance-based contracting: Payments linked to vehicle/fleet availability, emissions, and ridership performance.
- Fleet modernity and flexibility: Service providers incentivised to introduce new technology, facilitate upgrades, and innovate around TCO.
- Optimised funding: Leverages private or blended finance, making scaling more affordable for small jurisdictions.
-
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38 Very Light Rail (VLR) Hydrogen-Powered Vehicles

Technical Features

- Vehicle Design: Modular, bi-directional, low-floor, all-access, ~18-20m length, up to 56 seated and 60 standing capacity per vehicle11.
- Power Source: Onboard PEM hydrogen fuel cells (e.g., 4×40-60kW), with battery hybridisation for acceleration phases.
- Range and Refuelling: 150–200 km per refuelling cycle; refuelling in ~10 minutes; onboard hydrogen capacity ~32–40 kg12.
- Performance: Max speed ~70 km/h; energy-efficient; regenerative braking; air purification as an embedded environmental benefit.
- Infrastructure Compatibility: Runs on existing track with minimal modification; lighter weight reduces track wear and maintenance costs.
- Accessibility: 100% low-floor, step-free boarding, facilities for wheelchairs, strollers, and bikes, digital signage, and real-time information13.
- Axle weight max 10 tonnes or tare weight 25 tonnes
- Emissions: Only emission is water vapor; operates with zero direct CO2, NOx, PM emissions—directly supporting Net Zero goals15.

Deployment Readiness

- Commercial Contracts: Hyundai Rotem for Daejeon (34 vehicles, ~$210M), extensive ongoing pilots in Coventry (UK VLR) and other cities14.
- Testing & Line Demonstrations: Demonstrated success at test tracks (UK, South Korea), Aruba, and live passenger pilots.

Hydrogen Supply and Infrastructure

- Hydrogen Production: Localised electrolysis (green hydrogen from renewables) or blue hydrogen (ATR with CCUS, sourcing from UK supply chain); commercial supply possible given the Isle's connections and scale19.
- Storage and Safety: Above-ground safe storage tanks at tram depots; HSE/COMAH-compliant risk assessment and site layout.
- Distribution: On-site small-scale production or trailered deliveries are likely most economic for the Isle of Man's scale.

39 Business Case Template

In line with HM Treasury's Five Case business case model and local best practice, the following template supports structured investment appraisal and decision-making21. Key sections completed in context:

Strategic Case

- Policy fit: Direct alignment with Net Zero 2050, climate, infrastructure and transport strategies.
- Objectives: Decarbonise public rail transport, enhance economic productivity, increase local mobility, support tourism, and promote technological leadership.
- Constraints/opportunities: Infrastructure integration with existing lines; duty to preserve the Island's heritage; opportunity for bespoke, scalable urban/rural deployment.

Economic Case

- Options appraisal: "Do nothing," "Incremental upgrade," and "VLR-Hydrogen HTaaS investment" options — with the recommended option (HTaaS) scoring highest for carbon and economic performance at lowest risk and with greatest flexibility.
- Economic uplift analysis: Projected impacts on property values, business formation, jobs, and visitor spend considered (see Section 7).

Commercial Case

- Procurement gateway: Competitive PPP/HTaaS service provider procurement, with performance-based contracting, local SME engagement, and infrastructure interface oversight by the Department of Infrastructure.
- Revenue models: Payment for availability and performance, farebox revenue split, and value capture where applicable.

Financial Case

- Cost benchmarks: Based on commercial deployments, adjusted for Isle of Man scale local capex, opex, fuel costs, and whole life savings.
- Funding: Blend of public resources (infrastructure, limited rolling stock), private sector/PPP (fleet, fuelling, operations), and potential green/sustainable finance instruments.

Management Case

- Governance: Oversight by a new project board representing Treasury, DOI, and heritage groups; clear reporting and beneficial owner responsibilities.
- Risk: Comprehensive risk register (see Section 12), full ISO 31000 alignment24.
- Stakeholder engagement: Robust communications, including public and trade union consultation, visitor and disability groups, and local business outreach.

40 IOM Modelling and Financial Metrics

This section presents a detailed IOM model, employing established methodologies for transport business cases and incorporating Isle of Man-specific data, market benchmarks, and relevant sensitivities.

Capital and Operating Cost Benchmarks

VLR Hydrogen Vehicles and Infrastructure Cost Table

Cost Item	Unit Cost £ (2025)	Quantity (Example for 6 trams)	Total (£)	Notes
VLR Hydrogen Tram Vehicle	2,250,000 (per vehicle)	6	13,500,000	Based on Daejeon 2024 order (£6.2m for 34 = ~£2.2m/tram)
Depot hydrogen refuelling facility	1,500,000	1	1,500,000	Modular, scalable for Isle of Man size
Track (minor upgrades, slab track)	500,000/km	10	5,000,000	Upgrades where required (estimate)
Hydrogen production (onsite electrolysis)	2,000,000	1	2,000,000	Optional; offsite/trailering lower cost
Maintenance infrastructure (tools, parts)	750,000	1	750,000	Highly modular, can be shared
Contingency (15%)	N/A		3,350,000	Standard for project class
Total			26,100,000	

Key points:

- Capex cost for full demonstration-scale deployment: ~£26 million
- Opex (maintenance, staffing, energy/hydrogen, track): ~£1.9m/year (average over 20 years, assuming savings in energy and maintenance offset possible increased costs in hydrogen supply, which are expected to fall over the project lifecycle)15.

Hydrogen Fuel Cost Benchmarks

Hydrogen Source	**Levelised Cost (£/kg H2)**	**Notes**
Onsite green (PEM electrolysis, 2025-30)	4.50–7.00	UK/EU forecasts; strong downward trend
Blue hydrogen (import)	2.80–4.00	Includes CCUS; subject to UK market development
Industrial/grey (interim, not net-zero compliant)	2.00–3.00	Not recommended for zero-carbon business case

Hydrogen consumption for VLR (est.): ~0.5–1.2 kg H2 per vehicle per km; ~8,000-10,000 km annual average per tram (fleet 6 trams = up to ~60,000 km/year; annual consumption ~48–72 tonnes). Annual hydrogen fuel cost: ~£350,000–£500,000, subject to local supply.

Ridership Forecasts

Existing and Projected Rail Ridership, Isle of Man

Year	MER + Steam + Horse Trams	Notes
2022	494,045	Post-COVID recovery, poor weather season
2023	582,952	Strong heritage and cruise return, peak year
2024	556,069	Estimate, full-year figures not final

Ridership growth assumptions with VLR/HTaaS:

- Modern service, climate credentials, improved frequency, better local access: estimated 10–20% uplift in first three operational years.
- Stronger recovery of local commuting, enhanced accessibility, visitor mobility, and potential integration with active travel.

Scenario	Ridership p.a. (2028, 'new normal')
Base case (heritage)	570,000
VLR/HTaaS introduced	650,000–725,000
High scenario (full integration, tourism push)	800,000

Farebox Revenue Impact

- Average fare: £3–£4 (weighted mix of heritage, commuter, group, visitor pricing).
- Additional annual farebox revenue: +£250,000–£700,000 (uplift).
- Potential for integrated product/visitor passes, local travel discounts, school engagement to drive further use.

Wider Economic and Socio-economic Impact

- Property uplift: International evidence suggests house prices within 400m of new/modernised stations can rise 10–18%, with wider urban uplift up to 2% per additional km closer to modernised infrastructure27.
- Local business revenue: Expected 8–12% increase in business starts within 0.5km of upgraded stations or stops, and associated job creation (5–8 FTE per stop on average).
- Gross Value Added (GVA): Rail-based schemes in comparable rural/heritage markets yield £1.5–2.5 in GVA for every £1 spent within 10 years.

41 Funding and Financial Pathways

Funding Models Benchmarked

1. **Direct Public Funding (Grant/CapEx)**
   - Capital grants, borrowing, or asset-backed finance by the Isle of Man Treasury.
2. **Green/Sustainable Finance**
   - Green bonds or sustainability-linked loans, aligned with the Isle's Sustainable Finance Roadmap.
3. **Public-Private Partnerships (PPP) / HTaaS Model**
   - Special Purpose Vehicle (SPV) structure: Provider designs, builds, finances, and operates service under a concession or leasing agreement; government pays annual service/availability fee3.
4. **Land Value Capture**
   - Capture uplift in land/property values around stops, via levies or targeted business rate supplements, to part-fund capex or repay green bonds.
5. **Grant Funding and Co-Finance**
   - Potential eligibility for UK or European decarbonisation, sustainable transport, or innovation funding.

Pathway	Pros	Cons
Direct Public Funding	Full control, fast asset delivery	Full risk on balance sheet
Green/Sustainable Bond/Loan	Low-cost, taps sustainable investor base	Requires robust monitoring/reporting
PPP / HTaaS, Service Contract	Risk transfer, specialist operator, innovation	Contract complexity, payment obligation
Value Capture	Recycles local benefits, supports business case	Needs enabling policy/accounting

Recommended approach: PPP/HTaaS primary, with public contribution to infrastructure, supported by green finance, and a value capture supplement where local economic uplift is most evident.

Indicative Payment Profile (20-year PPP)

Year	Annual Service Fee (£)	Farebox Revenue Offset (£)	Net Cost to Treasury (£)
1–3 (ramp-up)	2,200,000	900,000	1,300,000
4–10	2,000,000	1,200,000	800,000
11–20	1,800,000	1,300,000	500,000

Total lifecycle cost: ~£38M net (discounted at 3.5%).

42 IOM and Financial Metrics Table

Metric	Value (mid-case)	Notes
NPV (20yrs, 3.5% discount rate)	£9.2M–£14.6M	Including economic uplift, GVA, property gains
IRR	5–7%	Higher if ridership and property uplift are maximised
BCR (Benefit: Cost Ratio)	1.7–2.4	Exceeds standard UK Treasury hurdle (>1.5)
Payback period	8–10 years	Including direct and indirect benefits
Emissions reduction (CO2e)	4000–6500 t/yr	Relative to heritage operation, conservatively estimated

Economic Impact and Uplift Analysis

Quantitative Economic Uplift Estimates

Table: Sample Economic Uplift Indicators

Area	Pre-HTaaS Value	Post-HTaaS Value	10-Year Cumulative Uplift	Source/Notes
Jobs supported	70 (rail division)	95+ (inc. skills, SME supply chain)	+25+ (direct)	Service, contracting, technology transfer
GVA (rail sector)	£8.5M	£11–13M	£20M+	Construction, operations, visitor economy
Local house price premium (<500m)	Baseline	+12–18%	£6–9M community value	Evidence from UK/EU LRT uplift studies
Business start-ups (per station/stop)	Baseline	+2–5	+30–60 over 10 years	Retail, hospitality near stops
Visitor spend uplift	£11.4M	£13–14M	+£17M	ARPU £24.50–£26 over increased ridership

Qualitative Socio-economic Benefits

- Skills and apprenticeships: Partnership with VLR providers brings latest technology skills, training for local engineers, operational management opportunities.
- Health and inclusion: Improved access, reduced air and noise pollution, facilitates active travel, supports vulnerable and mobility-impaired residents, aligns with Well-being of Future Generations ethos.
- Resilience and innovation: Positioning the Isle of Man as a demonstrator for net zero and digital mobility, with potential to export know-how.
- **Social capital**: Reduces car dependency, supports community cohesion, and strengthens the appeal of Manx urban and rural environments.

43 Ridership Forecasting Methodology

Method Overview

Ridership modelling integrates inputs from:

- Historical demand data (IoM rail, seasonal adjustments, visitor arrival data)
- Transport network access modelling and scenario analysis (TfWM PRISM, UKTram, ITRC models)31
- Land use and economic indicators (business density, local employment, property uplift)
- Elasticity analysis (fare, frequency, service quality)
- Stakeholder and public engagement outputs

Peak and off-peak, leisure and commuter traffic are estimated using capacity-demand assessment models, with validation from successive annual operational data.

Scenario Modelling

- Base case: Current ridership with modest year-on-year tourism recovery.
- VLR/HTaaS scenario: Integrated timetable, local fare concessions, evening services, improved accessibility.
- High growth (optimistic): Integration with bus active travel, strong tourism growth, event traffic (festivals, cruise, sports).
- Low growth (pessimistic): Adverse economic/weather conditions, slower adoption of hydrogen technology.

44 Strategic and Stakeholder Analysis

Key Stakeholders

- Isle of Man Treasury
- Department of Infrastructure and Rail Division
- Heritage/Visitor Economy Groups
- Isle of Man Energy and Utilities
- Local Authorities & Community Councils
- Business and Commerce Chambers
- Visitors, local residents, and commuter groups
- Unions/Employee Representatives
- Green finance/investor community
- Transport regulators and safety authorities

Governance and Oversight

- Stronger project board: Direct reporting to the Minister and Treasury, incorporating cross-cutting strategic expertise, and clear monitoring of climate and economic KPIs.
- Heritage integrity: Engagement with preservation societies, tourism boards, and accessibility/advocacy groups for shared governance.

Community and SME Engagement

- Commitment to local supply chains, marketing, and technology transfer in partnership with international vehicle and system providers.
- Public consultation and engagement in service planning, fostering community buy-in and future patronage.

45 Regulatory and Risk Environment

Regulation

- Transport safety (light rail and hydrogen): Recommended compliance with International and UK rail safety legislation, modified for Isle of Man law, and with hydrogen-specific storage, handling, and refuelling regulations (COMAH, HSE, etc.).
- Land use and planning: All depots, refuelling, and infrastructure upgrades subject to local planning, with COMAH and Seveso III thresholds for hazardous substances.
- Procurement and State Aid**:** Transparent, competitive procurement in line with best public sector and PPP practices, with public reporting and Value for Money appraisals.

Risk Register

Extract: Key Risks and Mitigations (See Annex for Full Register)

ID	Description	Risk Owner	Probability	Impact	Mitigation
1	Hydrogen supply chain disruption	Operator/Treasury	Medium	High	Dual-sourcing, phased deployment, contingency stock, local electrolysis capacity enablement
2	Construction delay/cost overrun	Operator/PMU	Medium	High	Fixed price contracts, experienced PM, Value Engineering, and early stakeholder engagement
3	Technology immaturity	Operator/Treasury	Low	High	Proven commercial vehicles only, technology readiness assessments, maintenance agreements
4	Demand/revenue shortfall	Treasury	Medium	Med	Conservative forecasting, demand management, flexible ticketing, revenue guarantees in PPP contract
5	Public acceptance and stakeholder resistance	Operator	Medium	Med	Inclusive consultation, heritage preservation, local benefit maxima, transparent communications
6	Regulatory change (hydrogen safety/environment)	Treasury	Low	Med	Regular review, policy engagement, ongoing compliance monitoring
7	Skilled staff shortages	Operator	Medium	Med	Training programmes, apprenticeships, local partner secondments, wage benchmarking

Full detailed risk register available on request — risk scoring, mitigations, and owner assignment following ISO 31000 principles24.

46 Case Studies: Comparable Hydrogen Tram Deployments

Daejeon Metropolitan Railway, South Korea

- Deployment: 34 hydrogen-powered trams, 39 km route, 45 stations
- Supplier: Hyundai Rotem
- Total cost: 1.48 trillion KRW (~£840 million) for entire line; ~£6.2m per tram including fleet, integration, and support infrastructure
- Key outcomes**:** First world-scale commercial order; hydrogen fuel from local food waste methane reforming; extensive air-purification function; significant local procurement; open by 202814.

Coventry Very Light Rail (VLR), UK

- Pilot: Hydrogen and battery VLR vehicles on segregated urban track, developed by Transport Design International (TDI), Eversholt Rail, BCIMO, WMG Warwick11.
- Distinctive aspects: Rapid, low-cost track installation, modular depot and maintenance, significant government and private investment supporting decarbonisation

Ulsan, South Korea

- Operation: World's first hydrogen line (Claimed), now live, with expansion planned to two lines by 2029.

Aruba

Aruba is making bold moves toward becoming a regional hydrogen hub, and the plans are genuinely exciting. breakdown of the hydrogen vehicle and infrastructure landscape specific to Aruba:

Deployment Plans

- Aruba's government signed a Memorandum of Understanding (MOU) with Acciona Energía in 2023 to develop a Green Hydrogen Valley at the former Valero oil refinery site in San Nicolas .

- The project will include:
- green hydrogen production plant powered by renewable energy.
- Infrastructure for storage, distribution, and vehicle propulsion.
- Integration with Aruba's existing utilities: WEB Aruba (water), Elmar (electricity), and RDA (refinery land).

Supplier & Partners

- Acciona Energía (Spain): Leading the development, construction, and operation of the hydrogen plant.
- Aruba's state-owned energy entities: Providing land, water, and grid access.
- The project is modelled after Acciona's successful hydrogen initiatives in Mallorca and Navarra, Spain3.

Total Costs & Infrastructure

While exact figures for Aruba haven't been disclosed, we can estimate based on similar projects:

Component	Estimated Cost Range
Hydrogen Production Plant	\$50M–\$100M USD
Refuelling Infrastructure	\$1M–\$2M per station
Hydrogen Vehicles (buses/trucks)	\$300K–\$500K each
Support Infrastructure (grid, water)	\$10M–\$20M USD

These figures will vary depending on scale, technology, and whether Aruba pursues export capabilities to nearby islands.

Key Outcomes Expected

- Energy independence: Reducing reliance on imported fossil fuels.
- Decarbonization: Cleaner transport and industrial processes.
- Economic development: Job creation and regional leadership in green energy.
- Tourism sustainability: Potential use in airport shuttles, hotel fleets, and public transport.

Ridership & Use Cases

- Initial deployment is likely to focus on public transport, municipal fleets, and logistics vehicles.
- Aruba's compact geography makes it ideal for hydrogen-powered buses and service vehicles.
- Ridership will depend on fleet size, but even a small rollout could serve thousands of daily passengers, especially in Oranjestad and tourist corridors.

Aruba's hydrogen ambitions are more than just a green dream—they're a strategic pivot toward a resilient, sustainable future.

Common lessons:

Strong government support, focus on innovation and climate policy alignment, robust stakeholder engagement, local skills/training maximised, barriers offset by NPV-positive economic/social returns.

. Project Implementation Roadmap

Phased Delivery Plan

Phase 1: Business Case Finalisation and Funding (2025–2026)

- Appoint PMU lead
- Secure green/PPP funding
- Stakeholder engagement and planning approval

Phase 2: Procurement and Design (2026–2027)

- Competitive sourcing for HTaaS provider
- Detailed design of depot, hydrogen supply, infrastructure upgrades
-

Phase 3: Construction and Commissioning (2027–2028)

- Track and facilities upgrades
- Depot and hydrogen station construction
- Vehicle manufacture and acceptance testing

Phase 4: Service Launch (2028)

- Soft launch and pilot operation
- Marketing push for local and tourist markets
- Data collection for early outcomes monitoring

Phase 5: Scaling and Optimisation (2029+)

- Increased frequency, routes expanded as value is shown
- Full integration with bus and active travel strategy
- Annual review and adjustment of KPIs

48 Monitoring, Evaluation, and Reporting

- **KPIs:** Emissions reduction, ridership growth, economic uplift (GVA and jobs), service satisfaction, inclusiveness/accessibility scoring, financial outturns vs. forecast.
- **Annual public reporting:** Including climate impact statement, stakeholder engagement outcomes, and lessons learned.
- **Mid-term evaluation (year 5):** Independent review of business case delivery, including recommendations for scale-up or optimisation.

Risk Ref	Description	Mitigation Strategy	Residual Risk	Owner
1	Hydrogen fuel cost volatility/reliability	Long-term supply contracts, local production capacity, and hedging	Medium	Dir/Operator
2	Delivery and supply delays for rolling stock	Phased procurement, multiple supplier engagement, critical path control	Low	PMU
3	Community/heritage group resistance to modern vehicles	Stakeholder engagement, preservation of heritage fleet, interpretive centres	Low	DOI/Heritage
4	Underestimation of upfront capital costs	Independent cost review, risk buffer contingency	Medium	Treasury
5	Health/safety incident (hydrogen related)	Best practice safety design, staff training, regulatory audit	Low	Operator
6	Service disruption (weather, asset failure, supply chain)	Robust maintenance, resilience planning, supplier diversification	Med	Operator
7	Regulatory/policy change (hydrogen, light rail)	Active policy engagement, ongoing compliance monitoring	Low	Treasury/DOI
8	Skills shortage or industrial action	Local skills investment, wage/benefit benchmarking, good industrial relations	Medium	DOI/Operator
9	Inflation/interest rate rise affecting funding costs	Index-linked payments, green debt structures, hedging	Low	Treasury
10	Failure to achieve expected modal shift/ridership	Service design optimisation, integrated marketing, continuous feedback	Medium	Operator

49 . Conclusion and Recommendations

The Hydrogen Trams as a Service (HTaaS) initiative represents a bold, yet fully evidence-based, strategy to future-proof the Isle of Man's rail network, support Net Zero targets, and catalyse a step-change in economic and social outcomes for the Island. Backed by proven technology, robust IOM and economic uplift projections, diverse funding options, and a comprehensive risk management approach, HTaaS can position the Isle of Man as a lighthouse in sustainable mobility and green finance. To realise these gains, it is recommended that:

1. The Isle of Man Treasury approves the HTaaS outline business case and enables progression to procurement under a PPP/HTaaS concession arrangement.
2. The Department of Infrastructure leads on structured public consultation, heritage integration, and detailed demand-side modelling to inform timetable and service design.
3. A blended funding package is assembled, leveraging sustainable finance to reduce public risk and maximise impact.
4. A robust project management and governance board is established, resourced with appropriate technical, commercial, and project leadership capacity.
5. Comprehensive monitoring, reporting, and risk management processes are baked into the operating model from project inception.

By taking early, strategic action, the Isle of Man can seize the dual climate and economic dividend, invigorate its heritage with world-class innovation, and establish a hallmark model for others committed to a sustainable transport future.

50 Cost-Benefit Summary: Hydrogen VLR vs. Do Nothing

Category	Hydrogen VLR Project (Est.)	Do Nothing Scenario (Est.)
Capital Investment	£45–£60 million	£0 (no new infrastructure)
Annual Operating Cost	£3–£4 million	£3.5 million (heritage ops)
Revenue Potential	£2.5–£3.5 million/year	£1.2–£1.5 million/year
Carbon Emissions Saved	~1,200 tonnes/year	0 tonnes/year
Tourism Boost	+15–20% visitor uplift	Flat or declining
Commuter Accessibility	Year-round service enabled	Limited seasonal access
Funding Eligibility	High (Net Zero grants, PPP)	Low (no innovation)
Strategic Risk	Medium (tech maturity)	High (inflexibility, decline)

Net Benefit Estimate (10-Year Horizon)

Metric	Hydrogen VLR	Do Nothing
Total Cost (10 yrs)	~£75–£90 million	~£35–£40 million
Total Revenue (10 yrs)	~£30–£40 million	~£12–£15 million
Net Cost	~£40–£50 million	~£20–£25 million
Intangible Benefits	High (green brand, mobility)	Low (status quo)

To calculate the **Cost-Benefit Ratio (CBR)**, we use the formula:

CBR=Total Benefits Total Costs\text{CBR} = \frac{\text{Total Benefits}}{\text{Total Costs}}

Let's apply this to both scenarios over a 10-year horizon:

Light Rail (UK)

Hydrogen VLR Project

- **Estimated Total Benefits**: Revenue: £30–£40 million Intangible benefits (carbon savings, tourism uplift, funding access): conservatively valued at £10–£15 million → **Total Benefits** ≈ £40–£55 million
- **Estimated Total Costs**: Capital + Operating ≈ £75–£90 million
- **Cost-Benefit Ratio**:

£40–£55 million£75–£90 million≈0.53–0.73\frac{£40\text{–}£55\text{ million}}{£75\text{–}£90\text{ million}} ≈ 0.53\text{–}0.73

Do Nothing Scenario

- **Estimated Total Benefits**: Revenue: £12–£15 million No carbon savings or strategic gains → **Total Benefits** ≈ £12–£15 million
- **Estimated Total Costs**: Operating ≈ £35–£40 million
- **Cost-Benefit Ratio**:

£12–£15 million£35–£40 million≈0.30–0.43\frac{£12\text{–}£15\text{ million}}{£35\text{–}£40\text{ million}} ≈ 0.30\text{–}0.43

📊 Interpretation

- **Hydrogen VLR CBR**: ~0.53–0.73
- **Do Nothing CBR**: ~0.30–0.43

Interpretation

While the hydrogen VLR project requires significant upfront investment, it offers:

- **Higher long-term revenue**
- **Substantial carbon savings**
- **Improved commuter and tourist service**
- **Access to external funding**

The "Do Nothing" path avoids capital costs but locks in operational losses, environmental stagnation, and strategic risk.

Light Rail (UK)

Doing Nothing Scenario:

1.Implications of Not Integrating Hydrogen-Powered Very Light Rail (VLR) on the Isle of Man

Introduction

The Isle of Man's railway network is globally renowned for its unique heritage character and as a fundamental asset for tourism, culture, and island mobility. Yet, the network today faces sustained operational, environmental, economic, and strategic challenges. In 2025, stakeholders commissioned the 'Do Nothing Scenario' report—part of the LRUK Triton pre-feasibility study—to explore the full implications of maintaining the status quo rather than integrating innovative, zero-emission hydrogen-powered Very Light Rail (VLR) systems. The report presents far-reaching consequences for infrastructure resilience, commuter and heritage services, environmental performance, economic sustainability, strategic risk, and stakeholder engagement. This summary provides an in-depth, section-by-section analytical synthesis that reflects the structure and findings of the original report.

Existing Rail Infrastructure Status Quo

- The Isle of Man's railway network consists of four distinct railways: Isle of Man Railway (IMR), Manx Electric Railway (MER), Snaefell Mountain Railway (SMR), and Douglas Bay Horse Tramway (DBHT). All are narrow-gauge and government-owned and operated.
- The historic fleet and infrastructure are largely original, making the network unique, but this results in elevated maintenance costs and operational complexity.
- The Isle of Man has thrice the railway track per capita than Great Britain, leading to disproportionately high per-user operational costs.
- Capital investment since 2009 prioritized essential renewals: MER and SMR tracks, DBHT infrastructure, and some locomotive overhauls. Annual capital outlay averaged £5m, falling to £2.5m in 2023.
- Current asset condition reflects years of underinvestment; maintenance has focused on safety and minimum operational standards without significant expansion, modernization, or enhanced integration with wider transport modes4.
- There are minimal opportunities for significant efficiency gains or cost reductions without harming service delivery or undermining the railway's economic and social contributions.

The current infrastructure state means the railways are technically operational, but innovation and integration limitations persist. The system remains heavily anchored in heritage operations, with only incremental improvements for resilience and performance. Such an approach results in limited flexibility to adapt to the fast-evolving requirements of modern public transport, environmental imperatives, and future population growth.

2. Operational Impacts of No Hydrogen VLR Integration

- Railways currently focus on leisure and tourist markets, with timetables favouring peak-season holiday travel rather than year-round commuter demand.
- Load factors are low across the network: IMR 26%, MER 31%, SMR 47%, DBHT 14%—all well below thresholds required for sustainable operations.
- Staff wages constitute 70% of total costs, with marginal room for further efficiency without service or employment reductions.
- Services outside the main season or at less busy times struggle to reach even variable-cost breakeven, forcing cuts or curtailed timetables to manage losses.
- Key network segments (e.g., Castletown-Port Erin and Laxey-Ramsey) face periodic consideration for service reduction or withdrawal, but modest cost savings risk disproportionate impacts on broader economic, connectivity, and social goals.

Absent VLR integration:

- No feasible pathway exists to re-profile timetables or service patterns to serve daily mobility/commuter needs due to the inflexibility of historic infrastructure, operational costs, and risk to heritage value.
- Proposals for new morning or evening commuter services are essentially unviable in the current operational framework, with cost-benefit ratios unfavourable for implementation1.
- Opportunities to optimize or dynamically adjust services—for instance, introducing high-frequency, short-haul commuter trains or linking new residential/population centres—are not realized.

The status quo traps the system in a cycle of underutilization, low-frequency, and uncompetitive service for day-to-day residents. Operations remain loss-generating and largely seasonal, diminishing the railway's relevance to broader transport policy or a modern, mobile population.

3. Commuter Service Impacts

- Recent studies have explored the introduction of new commuter-focused services—particularly using modern battery-electric or hydrogen-powered light trains—between Ramsey and Douglas, leveraging the MER and DBHT infrastructure with dedicated rolling stock.
- Extensive modelling shows that for a commuter service to offer positive value-for-money (BCR >1), at least 88 passengers per service are needed; this threshold rises to 104 if a lower proportion of car users switch to rail2.
- Benefits include reduction in road congestion, tailpipe pollution, and external social costs linked to car commuting—effects which are forfeited in the Do Nothing Scenario.
- Current infrastructure and rolling stock are ill-suited for high-frequency, short journey, or rapid turnaround commuter schedules.
- Journey time competitiveness is poor relative to buses, particularly from northern towns such as Ramsey, thus limiting market potential for a modal shift.

Without Hydrogen VLR:

- The island's railways cannot feasibly support modern commuter timetables due to technical constraints, cost structures, and incompatibility with heritage priorities.
- Residents remain dependent on private cars and buses, reinforcing existing congestion and emissions.
- Prospects for decarbonising island-wide commuting through modal shift are severely limited, and the railway risks further marginalisation from daily island life.

4. Heritage Rail Service Impacts

- The heritage character of the Isle of Man's railways is central to their public and economic value, being the top-rated tourist attraction and a linchpin of the island's culture, identity, and international profile.
- Successful heritage operation faces mounting challenges: aging infrastructure and rolling stock, dependency on a small volunteer base (25–70 individuals island-wide), and vulnerability to seasonal demand fluctuations.
- Any further cost reductions or aggressive service cuts would undermine the railway's wider economic benefits and its role in dispersing visitors around the island.
- Heritage value is strongly validated by public consultation (over 70% ranked heritage highly, 16% cited "identity" as a key attribute).

Maintaining Status Quo:

- Preserves the current structure but precludes evolution—risks stagnation in visitor appeal, limits innovation potential (such as blended heritage/commuter operations), and increases vulnerability to shifts in visitor demographics or economic shocks.
- Greater volunteer requirements cannot be supported by the small island population, leading increasingly to professionalisation and associated costs.
- The system risks becoming less competitive against other visitor experiences and less resilient to future challenges.

5. Environmental Consequences

- The Isle of Man is committed to net zero emissions by 2050, with interim targets for a 15% reduction in transport emissions by 2027 and 35–45% by 2030–356.
- Current rail operations—steam-powered and diesel-powered rolling stock—significantly contribute to local air pollution and greenhouse gas emissions. Rail traction emissions are not separated in national statistics but are substantial.
- The Do Nothing Scenario means the continuation of fossil fuel dependence: coal for steam trains (increasingly hard to source following UK mine closures) and diesel for supporting operations.
- Opportunities to reduce island emissions via modal shift to green rail (hydrogen-powered VLR or battery electric) remain unrealized; emissions from private cars (60% of transport sector) also remain largely unmitigated5.
- Heritage coal importation, if UK sources cease, implies higher emissions due to longer shipping routes.

Without new technology:

- Environmental benefits from rail decarbonisation are lost, and the island risks failing its climate targets.
- The UNESCO Biosphere designation is at risk if visible coal and diesel use persists, damaging environmental credentials and sustainable tourism status.
- Failure to modernise also forgoes co-benefits—air quality improvements, health, and active travel—reported in comparable hydrogen and battery-powered rail implementations.

6. Social Consequences

- Railways form a critical component of Manx identity, supporting community cohesion, accessibility, and intergenerational links (non-use value estimated at over £5.2m/yr).
- Social value is stable or declining with current patterns: limited accessibility for residents (especially the elderly, disabled, or those without access to cars), reliance on a shrinking pool of volunteers, and limited appeal to new users outside heritage tourism.
- Accessibility is variable; historic vehicles and infrastructure are not universally designed for people with reduced mobility, further limiting social inclusion.

No modernization:

- Limits social inclusion, constrains mobility for non-drivers, and reduces potential to address equity goals in future transport strategies.
- Potential public disengagement if services are perceived as static, elitist, or unresponsive to broader social needs.
- Volunteer fatigue and limited recruitment threaten continued operation without professional (more costly) staff.

7. Economic Implications

- The railway system delivers around £17m annually to the Manx economy, with tourism constituting £12m—rail users stay longer and spend more per visit1.
- For every £1 of subvention, the railway generates £4.64 in economic benefit (falling to £2.88 including capital expenditure costs). However, direct operating revenue falls far short of covering costs.
- Expenditure (£5.7m in 2024) substantially exceeds revenue (£2.2m), with operating losses of £2.25m and overall annual losses of £3.5m.
- Low ancillary revenue (retailing, catering, commercial partnerships) at 7% (vs. up to 30% in UK comparators) means reliance on government subvention will persist absent diversification or value enhancement.
- Opportunities for economic growth—extended visitor season, new commuter markets, diversified services—are foregone without modernisation.

No VLR integration:

- Economic impact plateaus, railway dependency on subvention remains, and opportunities for commercial or service innovation are lost.
- The system fails to capture new visitor or resident segments, with cost structures unchanged and limited levers for future revenue generation.
- Wider multiplier effects—employment in tourism/hospitality, skills development, supply chains—remain below their potential.

8. Funding and Financing Implications

- Funding for the rails remains static or falling in real terms. Capital spending has reduced from £5m annually (2016–2022 average) to £2.5m in 202311.
- Ongoing net losses and high fixed costs restrict financial flexibility; tight revenue margins and the absence of new business models curtail the ability to invest in upgrades.
- Subvention (government support) has remained broadly constant since 2018 but constitutes a significant and increasing share of the system's financial base.
- Without new sources of revenue or lower-cost/low-emission technology, long-term sustainability is at risk. Funding for resilience, innovation, or emergency intervention is crowded out by day-to-day operational needs.

Do Nothing Scenario Outcomes:

- The funding model is increasingly unsustainable, especially under future economic constraints or reduced political support for direct subsidy.
- Any reduction in subvention threatens core service levels, threatening the network's current and future viability.
- The possibility of leveraging public-private partnerships or unlocking new financing for green upgrades is missed.

9. Strategic Risks and Future Challenges

- The most significant risks stem from inertia: declining relevance, financial instability, and missed integration with sustainable transport policy.
- Network development stagnates: inability to flex, scale, or adapt to changing travel behaviours and climate targets.
- Population growth targets (to 100,000 by 2037) and wider economic ambitions are unsupported by a static, outdated network.
- Shrinking volunteer base, high fixed staffing, escalating maintenance costs, and inadequate engagement with key economic and tourism agencies compound long-term threats.
- Curtailing services or closing segments (notably IMR Castletown-Port Erin or MER Laxey–Ramsey) yields little net benefit and may undermine tourism, visitor experience, and prior investments.

In Summary:

- A lack of strategic adjustment exposes the system to risk of obsolescence, negative public perception, and inability to deliver public value or meet decarbonisation goals.
- Failure to align with wider transport and emissions strategies may damage the island's international reputation and economic future.

10. Stakeholder Effects and Perspectives

- Current stakeholders—Department of Infrastructure (DoE), Department for Enterprise (DfE), Visit Isle of Man, Manx National Heritage, and supporter/volunteer groups—express concern over long-term viability without modernization.
- Volunteer engagement is below UK heritage railway norms, and waning due to aging population and limited community recruitment.
- Calls to form a Board of Directors echo best practice in arms-length governance and strategy, aiming for more professional leadership and cross-sector collaboration.

Status Quo Implications:

- Engagement risks decline, with volunteers and local businesses questioning value and sustainability in the absence of reform.
- Coordination gaps between railway management and tourism development agencies limit marketing, event planning, and business resilience.
- Service reductions, especially if implemented in key segments, are likely to provoke strong opposition from the community and special interest groups.

11. Alternative Future Rail Options

- Multiple governance and reform models are considered:
  - Commercial operation: Deemed unviable due to limited cost-reduction potential and inevitable subvention requirements.
  - Charity/trust: Would still require government support and lacks necessary capital access and volunteer base.
  - Publicly owned arm's length company: Recommended as best model to facilitate strategic planning, stakeholder engagement, and long-term investment.
- Alternative use of routes (e.g., converting Laxey–Ramsey section to a cycle path, or implementing single track) found non-viable unless exceptionally high usage is achieved; capital costs and seasonal tourism patterns undermine value.
- Integration of hydrogen-powered VLR, or at minimum battery-electric/light rail vehicles, is identified as critical to unlocking operational and economic transformation—otherwise, modernization options are severely limited.

No Embrace of Alternatives:

- Status quo persists with incremental improvements only. Key opportunities for economic, social, and environmental transformation are lost.
- System becomes increasingly peripheral in future transport, tourism, and environmental policy.

12. Comparative Case Studies of Hydrogen VLR

- Hydrogen VLR systems in the UK—Coventry VLR, Alstom Coradia iLint, and various innovation programmes—demonstrate significant environmental benefits, improved service flexibility, and resilience13.
- Battery-only Revolution VLR vehicles and Coventry VLR prototypes offer evidence for operational utility, market interest from established operators, and rapid, cost-effective deployment in regional rail contexts.
- Alstom's hydrogen-powered Coradia iLint has successfully completed long-range passenger runs, offering a proven, zero-emission solution for non-electrified lines.
- UK Traction Decarbonisation Network Strategy recommendations include battery and hydrogen traction for low-density, non-electrified networks—directly analogous to the Isle of Man case16.

Isle of Man's Position If Doing Nothing:

- Loses potential first-mover advantage and the reputational, operational, and funding benefits already pursued elsewhere.
- Misses cost-reduction, emissions-cutting, and innovation opportunities validated in real-world regional pilots.

13. Thematic Insights Table

Theme	Status Quo/Do Nothing	Hydrogen VLR/Alternative Integration
Service Focus	Tourism-dominant; low commuter utility	Mixed: tourism + daily commuter service
Economic Impact	£17m annual impact (static); high subvention	Potential for growth, diversification, and less subvention
Volunteer Base	25–70; unsustainable for full operations	More attractive/engaged with modernisation
Climate/Environmental	Ongoing GHG emissions; fossil fuel reliance	Significant emissions reductions are possible
Heritage Value	Preserved, with risk of stagnation	Evolves; enhanced by blending tradition and innovation
Operational Model	High fixed staff costs; inflexible timetabling	Greater automation, efficiency, and flexibility
Capital Renewal	£2.5–5m/y, declining, risk underinvestment	Opportunity to attract external grants/private capital
Stakeholder Engagement	Declining; uncoordinated	Stronger, more cross-sector leadership
Strategic Alignment	Poor alignment with decarbonisation, population growth, or smart tourism	Strong enabling role for net zero, population, and economic targets
National Reputation	At risk: potential UNESCO biosphere status loss	Enhanced as an innovation leader

This table summarises major contrasts between maintaining the status quo and seizing the potential of rail innovation.

While preserving certain values, the Do Nothing scenario distinctly falls short on critical axes shaping the future prosperity and sustainability of the island.

14. Conclusion

The ‘Do Nothing Scenario’ report makes clear that simply maintaining current operations on the Isle of Man’s unique heritage railway assets is not a neutral act.

Rather, it represents a path of increasing risk—financially, operationally, environmentally, and strategically. Not adopting hydrogen-powered Very Light Rail, or at least a similarly transformative technology, perpetuates a cycle of growing subvention, declining relevance, missed opportunities in decarbonisation, and stagnation at precisely the moment public transport must innovate to thrive.

The failure to modernize ensures ongoing high emissions, lost economic opportunities, and growing alienation of key stakeholders, including government funders, volunteers, residents, and visitors.

While heritage rail remains a cherished legacy, without careful integration of green innovation, its future is uncertain and its wider contribution to the island’s prosperity and sustainability will remain constrained.

Comparative case studies, both from within the UK and Europe, further highlight that inertia is not merely the absence of action but a decision to fall behind.

Against a backdrop of tightening climate targets, rising operational costs, evolving visitor expectations, and a population with changing mobility needs, doing nothing risks the slow decline of one of the Isle of Man’s cultural and economic jewels.

Strategic, integrated planning and bold investment in zero-emission, flexible rail technologies offer the best route out of this cul-de-sac, towards a thriving, sustainable, and inclusive future for railways on the Isle of Man.

Light Rail UK & Associates

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